52.28

SD
11
.R5

DEER HABITAT MANAGEMENT

Everett R. Doman, U. S. Forest Service
R-05

Prepared for Deer Seminar sponsored by California Agriculture Extension Service and presented at Eureka, Calif., Nov. 30, 1965.

INTRODUCTION

Game management is the art of making land produce optimum sustained annual crops of game animals consistent with other important and necessary uses of the same lands. Applied to deer management in California the California Fish & Game Commission policy is "to produce and maintain a maximum breeding stock of deer on all wild lands in California, public and private, consistent with other uses of such lands, and to utilize, through public hunting, the available crop of deer produced annually by this breeding stock".

From these definitions it can be seen that deer management has two facets:

1. Management of the animals - This includes the phases of management concerned with protection and harvesting.

2. Management of habitat or the land on which the animals live.

As we get further into our discussion you will see that these two facets are closely interrelated. One cannot be fully achieved without the other. Management of habitat to keep it in a highly productive condition requires careful management of the animals. Careful management of deer implies protection from hunting and predators when populations are low, and removal of both sexes through hunting when a population has reached the capacity of its habitat.

Definition of Habitat

Webster defines "habitat" as: 1. The region where a plant or animal naturally grows or lives; native environment. 2. The place where a person or thing is

ordinarily found.

Habitat consists of the climate, the air, the topography, the wind, the soil the water, and the vegetation. Basically the quality of wildlife habitat can and does vary greatly from locality to locality. It can be highly productive or it can be mediocre or low in productivity.

Of all the factors that make up deer habitat only three (food, water, and cover) can be altered by man in any significant degree. Such alterations can be purposeful or accidental. From a deer welfare standpoint they can be good or bad.

Habitat management then consists of purposeful manipulation of vegetation which supplies food and cover and of water supplies to meet the needs of the animals.

Habitat requirements of Black-tailed Deer

Heavy Cover:

The black-tailed deer would rather hide than run from danger. Therefore, dense vegetative cover is essential for this animal. In addition to protection from man and other natural enemies, cover is often needed to protect deer from storm, cold and winds. Aside from the needs of deer for protection, vegetative cover is also essential to stabilize and protect the soil from erosive forces of nature.

Black-tailed deer are found in four main cover types in California. These are:

(1) Chamise
(2) Mixed Chaparral
(3) Oak-Woodland
(4) Coastal and inland forests

Along the coast of California the first two types ordinarily occur in close proximity. The chamise occupies the south facing slopes and drier sites. The mixed chaparral is found mainly on the north exposures and in the bottoms of the draws or drainage ways.

The mixed chaparral also covers extensive areas in the Sierra foothills. This type consists of an association of fire tolerant shrubs many of which sprout from the crown after fire. The main components of the mixed chaparral are chamise, oaks, manzanita, coffee berry, several species of ceanothus, chaparral pea, toyon, and birchleaf mahogany.

Old stands of both chamise and the mixed chaparral form dense closed canopies that keep out sunlight. Due to lack of sunlight and competition from the dense brush there is usually very little herbaceous vegetation in the understory of these old stands and consequently low food production. Both types provide excellent cover for deer.

The oak-woodland type consists of scattered (large) trees with a well developed herbaceous understory of weeds and grasses along with some low shrubs. The type provides several kinds of preferred foods for deer during much of the year and is used where there is adjacent heavy cover that the deer can get into when not feeding.

The coastal conifer forest type extends from the northern 1/3 of California north through Oregon, Washington and British Columbia. Douglas fir usually predominates. Other trees making up the overstory include redwood in the southern part of the type; and spruce, hemlock, and cedar in the northern areas. The type provides excellent cover but poor foraging conditions unless modified through cutting. The

same is true of the inland forests in the Sierra-Cascades but often not to the same extent. Ponderosa pine stands, for instance, often are characterized by a fair ground cover consisting of both herbaceous and shrubby vegetation. The inland forests, generally, offer more deer food than do the coastal forests.

Food

A second element of the habitat that is subject to management is the food supply. The quantity and quality of the food supply is usually the most important factor in determining how many deer any given range will support. Since deer do not hibernate they must have adequate food in winter and in summer. In localities where deer migrate in winter from high summer ranges to low elevation winter range, the seasonal unit where food occurs in least quantity limits the size of the deer herd. Generally, with migratory herds, winter food supply becomes the limiting factor. Also, most black-tailed deer populations are limited by food quality to a greater extent than by food quantity.

All the plants that grow on a range are not good deer food. It is true that, on overcrowded deer ranges, all plant species may be eaten to some degree. But deer can die of malnutrition with their stomachs full of vegetation of low nutritive value. The fact that a hillside is covered with brush does not necessarily mean that deer food is plentiful. Many of the plants may be seldom eaten because of low palatability. Others may have grown out of reach and be entirely unavailable. Brush types can become so dense that sunlight cannot filter through. Such types have very little herbaceous vegetation on the ground. Because of such conditions, many hillsides that are densely clothed with brush may be deserts as far as deer food is concerned.

Animals have ability to select plants with highest nutritive value. Experiments with sheep and cattle have shown that on a range where crude protein content of

vegetation averaged from 3.4 to 5.2 percent the plants and parts of plants taken by sheep averaged 7.2 to 10.6 percent and by cattle 6.7 to 8.3 percent (12). This indicates the importance of conservative stocking so that the animals have free choice of the most nutritious foliage and are not forced onto inadequate diets.

In a discussion of what black-tailed deer eat, Taber and Dasmann (8) describe "the ideal diet and the real diet". These authorities on deer range ecology point out that if a deer lives in an area where all preferred food plants are present in ample quantity "it will largely eat grass and herbs in the late winter and early spring, brush sprouts in the late spring, brush sprouts and succulent herbs in the summer, and browse and acorns in the fall". They point out that on the range where the deer were originally the most numerous -- the open oak woodland with interspersed brush patches -- foods of these types were all available. Much of this type of land within the black-tailed deer range is now being farmed or is used for sheep and cattle grazing. Deer have had to shift into the chaparral where some of the preferred diet items are in short supply. In the average present day black-tailed deer habitat one of the main deficiencies is herbaceous food -- grass and succulent herbs or forbs. These succulent plants are usually much higher in nutritive value during late winter and early spring than are the brush species and deer will come through the winter in much better condition and with fewer winter losses where such foods are available.

Table 1
A Comparison of the Optimum with the Usual Diet
(From Taber & Dasmann)

Season	Preferred food (where present)	Actual food eaten on heavy brush range
Nov - Dec	Acorns, browse, some new growth of grass and herbs.	Mostly browse
Jan - March	Mostly new growth of grass & herbs	Mostly browse
April	New growth of brush	New growth of brush
May - Aug.	Succulent herbs, some browse	Mostly browse
Sept - Oct.	Acorns, some browse	Mostly browse

I will not attempt to go into detail in naming all the plant species that are of importance in the diet of black-tailed deer. If any of you desire such information I refer you to Taber and Dasmann's publication -- "The Black-tailed Deer of the Chaparral" which was published in 1958 as Game Bulletin No. 8 of the California Department of Fish & Game and to the various deer food habit papers that have appeared in State publications. However, since brush species make up so much of the deer diet I do want to point out a few that studies have shown are preferred by black-tailed deer in northwestern California. These are mountain whitethorn (Ceanothus cordulatus), deerbrush (Ceanothus integerrimus), birchleaf mahogany (Cercocarpus betuloides), mountain mahogany (Cercocarpus ledifolius), Fremont silk tassel (Garrya fremontii), bitter cherry (Prunus emarginata) and California redberry (Rhamnus crocea). Palatability of plants for deer varies in different sections of the deer range. It seems to be related to soil types and various chemicals found in the soil.

Under usual weather conditions, browse shoots and twigs become woody and tough by mid summer. Also by this time of year green succulent herbaceous plants are in short supply. By August and September most deer are eating browse of low quality and are losing weight. Thus, on ranges where deer are non-migratory, such as coast ranges of California, the critical food supply period for deer is often late summer when herbage is dry and the forage offered by most shrub species is low in food value. The few species that are high in nutritive value during this period (such as California bay, buckeye, birchleaf mahogany and mountain white oak) are apt to be preferred and critical foods. The presence of such forages may be the difference between high or low deer mortality in late summer. This critical period often lasts until fall rains bring out green feed. Cold winters when heavy frosts kill back all new growth, are also critical.

In good acorn years, on ranges where oaks are present, acorns are a preferred

food in late summer and fall. Acorns are high in fats and carbohydrates and are a valuable forage at a season when other foods are low in quality.

Water

The third habitat factor that can be manipulated to the benefit of deer is water.

Through much of the year water is no problem for black-tailed deer. They almost never drink during winter on the snow-covered parts of the range. In the spring of the year the highly succulent diet plus raindrops or dew on foliage eaten supplies adequate moisture. However, during the heat of the summer and especially for does that are nursing fawns free water in streams, lakes or ponds becomes important. Black-tailed deer range in the coastal mountains usually has enough sources of permanent free water to satisfy the needs of the deer. Water can be in short supply and a limiting factor to deer use of some of the dry west slopes of the Sierra during summer.

Good black-tailed deer habitat then has well dispersed patches of heavy cover, mixed browse types that are open enough to allow a fair understory of herbaceous plants, and well spaced water sources sufficient to supply the animals needs. All of these needs must be present. If any one essential element is lacking the area is not habitat at all.

EFFECTS OF INADEQUATE HABITAT ON DEER

In the discussion to this point, habitat has been defined and some of the important habitat requirements of black-tailed deer have been discussed. I now want to take a few minutes to emphasize the importance of maintaining good habitat conditions - particularly forage conditions. To do this I will cite studies made on black-tailed deer range as well as on range of other deer species in various

parts of the United States.

Many examples are available to illustrate the effects of poor forage conditions on deer herds and their ranges. These effects show up in several ways: (1) Die-off during critical periods; (2) marked reduction in the ranges carrying capacity in future years; (3) effects on the physical condition and reproductive rate of surviving animals; (4) excessive damage to other resources such as timber and agricultural crops.

Repeated die-offs have occurred among migratory deer herds in California since the mid 1940's. The authors of "A Survey of California Deer Herds"(5) believe that "more deer died on the west slope of the Sierra during the winter of 1948-49 than were reported taken by hunters in the entire state during the 1949 season". They attribute this loss to malnutrition as a result of "too many deer on too little winter range".

An intensive study of the Jawbone Deer Herd and its habitat in Tuolumne County, California was made from 1947 to 1950. Deer were found to be far in excess of the carrying capacity of their winter range. In the late fall they would arrive on the winter ranges in good condition. By February and March the twig growth of the more nutritious and palatable plants was almost completely used and the fawns and old adults were on the fringes of starvation. Under these conditions losses were heavy during even moderate winters and in the severe winter of 1948-49 it was estimated that over one-third of the herd died (5).

The North Kaibab Deer Herd in Arizona remains a classic example of a deer herd that built up in numbers beyond the capacity of its habitat. As early as 1918 there was recognition that the large number of deer was beginning to influence the condition of the range. However, no effective action

was taken and by 1924 deer had seriously depleted the forage supplies on much of the summer as well as winter range. Large losses, numbering in the thousands occurred in the winter of 1924-25 and continued for several years. Dead deer were found on both summer and winter ranges. The herd estimated to number 100,000 animals in 1924 dropped to an estimated 14,000 in 1932. With the lowered deer numbers the range recovered slowly and the deer herd also increased despite hunting of both sexes. Hunting pressure was not enough to keep the deer from again over using their forage supply. Another large die off occurred in 1954-55 when it is estimated that herd numbers dropped from about 28,000 to 12,000. An effecitve hunting program, starting in 1956 has shown that the Kaibab Deer Herd can be kept within the limitations of its range if intensively managed (7).

Several studies have been made of fawn production in relation to range or deer habitat condition. These studies show that the ability of does to produce fawns varies widely and is correlated directly with food supply.

In "A Survey of California Deer Herds" (5) it was noted that on ranges rated "as being in the best relative condition, such as Cow Mountain and the Truckee River Canyon, fawns averaged over 70 per 100 does at midwinter". On the poorer condition ranges "fawn numbers were considerably lower" and dropped to as low as 33 per 100 does on a very poor condition range in Inyo County.

In New York State a comparative study of fawn production was made in the mid 1940's with the following results (1):

Southern Tier of Counties	Adirondacks
Deer within capacity of habitat	Winter deer yards overbrowsed
Very little winter deer loss	Excessive losses in hard winters
92% of does pregnant	78% of does pregnant
33% of female fawns bred in first year	4% of fawns bred
33% of does had single fawns	81% of does had single fawns
60% of does had twins	18% had twins
7% had triplets	1% had triplets

In the intermountain area a comparative study was made of the number of embryo's carried per doe. Does that had been on good summer range in the Sublett Deer Herd Unit in southern Idaho had an average of 1.85 embryo's per doe. Does from a depleted habitat in central Utah averaged only 1.19 embryo's per doe.(4)

In addition to increased fawn production and survival good habitat conditions are reflected in larger deer and better antler development. The first antlers of deer on impoverished ranges will be predominantly small spikes. However, when nourished properly on good condition ranges this first set of antlers will be mainly "forked horns" and often even 3 or 4 pointers. Thus good habitat reflects not only in numbers of deer but in deer quality which is very important to most sportsmen.

The final effect of inadequate natural food supplies that I want to talk about is the excessive damage that often is done to other important resources such as timber and agricultural crops.

Much of the black-tailed deer range in California is private land. Large acreages in the foothill and valley borders that now produce agricultural crops or have been developed for homesites were formerly some of the most productive deer ranges. When deer numbers build up beyond the capacity of their present range and food supplies become scarce, it is to be expected that deer will invade the adjacent vineyards, orchards, alfalfa and grain fields, truck crops, artichoke patches and other agricultural lands where green and succulent forage can be obtained.

With the large numbers of deer that are presently existing on the 8,000,000 acres of private commercial forests in California it is also inevitable that considerable damage will be done to conifer seedlings. A recent animal damage survey was made of timberlands in northcoastal California by the California Pest Control

Action Council. Economic damage by animals was found to have occurred on 51 percent of the stocked sample plots on commercial timberland and on 61 percent of the stocked sample plots on plantations. Deer were responsible for the damage in 90 percent of the instances in the commercial timberlands and for 63 percent of the damage in plantations.

In 1964 a record high of 2,786 deer were killed in California on depredation permits to help protect lands from deer damage. While this, no doubt helped to some small degree it is at best a stop-gap measure. Deer damage is bound to continue on a growing scale as additional lands are developed within deer habitat unless effective measures are taken to keep the deer numbers in balance with the natural food supply. Fencing, repellents, and depredation shooting will continue to be needed. However, the most practical method of easing the depredation problem is through planned removed by hunters of surplus deer of both sexes in regular or special hunts before they increase to such an extent that they damage their natural range (10).

HABITAT SURVEYS

Since maintenance of good habitat is so important to the health of deer it follows that the first step in purposeful deer habitat management is a survey of habitat conditions.

The objectives of habitat surveys may differ on public lands and private lands. The private landowner is ordinarily not primarily interested in management of his lands for deer. While most landowners are glad to have, or at least will tolerate, a moderate number of deer they will be primarily interested in how the deer are affecting the productive capacity of their land for domestic livestock, timber crops, etc. The public land manager will be interested in a balanced program of land use

and coordination of deer habitat management with all other important uses of the land. Some areas that are highly important to deer, for example critical deer winter ranges, will be managed primarily for deer habitat and other uses will be adjusted to eliminate conflicts. In either case habitat surveys are needed.

Key Areas

A priority job in habitat surveys is to find the key areas. Deer are creatures of habit and no matter what is done to improve ranges they will tend to use some areas, year after year, more heavily than others. These are termed "key areas" since they are truly the key to habitat management. If these areas can be improved the response in the deer herd will be immediate. If the key areas are going downhill the deer herd is headed for trouble. In actual management of deer range a careful determination of where key areas are located is well worth the effort. Once they are accurately located future studies can be greatly facilitated. It will no longer be necessary for the game manager to annually inspect the entire range. He can be assured that if the trend in vegetative condition is uphill on these key ranges there is no cause to worry about the remainder of the deer range.

Study Transects

After locating key areas the deer habitat manager will need to establish some type of study transects on representative portions of the areas to which he can go, at intervals, to determine condition and trend of the important deer forage plants and trends in soil stability. Ordinarily he will establish one or more of the following types of simple administrative studies:

1. Classification of condition and trend of key plants
    a. Browse transects (form and age class of browse)

2. Installation of permanent trend transects (3-step)
3. Browse production measurements
4. Forage utilization measurements
5. Pellet group counts

Habitat Condition and Trend

On ranges where browse is the key forage, deer range condition can be determined by classifying the age and form class of important shrubs on permanently marked browse transects. All the browse plants rooted within the strip transects or circle plots are classified. In this classification the Forest Service uses a method developed by Dasmann (3a) in which 5 age classes and eight form classes are recognized. Age classes are seedlings, young shrubs, mature shrubs, decandent shrubs, and sprouts. Form classes are:

1. All available, little or no hedging
2. All available, moderately hedged
3. All available closely hedged
4. Largely available, little or no hedging
5. Largely available, moderately hedged
6. Largely available, closely hedged
7. Mostly unavailable
8. Unavailable

Special forms have been devised for readily and systematically recording the data. Under this system a particular shrub would be recorded as "M-3" if it is a mature shrub, all available and closely hedged. A minimum of 100 plants of each of the important browse species is classified.

Trends are determined with this system by repeat observations in future years. For example, if the initial classification of a palatable and important browse species showed a high percent of mature and decadent plants-closely hedged and few if any young plants, the browse condition would be classed as poor. If, after a several year interval, a remeasurement showed a number of young plants and some growth getting away beyond the old hedged surface, the trend for this species would be up.

Forage Utilization Studies

Range plants can withstand a certain amount of annual cropping without permanent damage. In fact annual growth on many of the shrubs important as deer food is stimulated by light or moderate use. Methods have been devised to measure utilization of current herbage production. Generally studies have indicated that browse plants can withstand from 40 to 60% removal of current annual growth each year and remain productive. When cropping is heavier than allowable the plants weaken, thin out, and eventually die. Less palatable plants, that receive lighter use fill in their places and range deterioration is well on its way.

The beginning stages of deer range deterioration are not obvious except to the specialist trained to recognize trend and overuse indicators. Even the experienced and trained biologist cannot rely on memory. Herein, lies the importance of carefully laid out forage utilization studies and yearly observations. A severely depleted habitat will take a long period to recover. But, the beginning stages of downward trend can be quickly reversed in just a few years if immediate corrective action is taken. Therefore, in deer habitat management it is extremely important that the land manager have current information each year regarding how the important forage plants are being used and that recommendations of trained professionals based on their field studies be accepted and carried out.

Deer habitat management is a field in which you "can have your cake and eat it too." Deer cannot be stockpiled. After the herd builds up to the capacity of its habitat, full utilization of the annual herd increment promotes full production and healthy deer. It has been pointed out that waste of surplus game animals by under cropping after the animals are at the capacity of their habitat "is no more conservation than "saving" apples by leaving them on the trees" (11). Since uncontrolled deer numbers invariably reflect on health of the deer and health of the deer range, it follows that the best kind of habitat management also requires management of the animals.

But here I am tending to step over into someone else's seminar topic. However, I want to clearly stress this fact before going to the final part of this habitat management discussion -- the subject of habitat improvement. It is futile and and generally a waste of dollars to try to improve deer habitats unless the animals are also managed to make the most of the improvements.

DEER HABITAT IMPROVEMENTS

While there are numerous ways in which natural deer habitats can be improved. The most effective means is through manipulation of vegetative types. The three types in which greatest improvement can be made are the chamise, the mixed chapparal and the coastal forest. Ordinarily the forest types are of high economic value for the production of wood products and here habitat improvement for deer is usually by the indirect approach of coordination with timber management activity.

Improvement of Timbered Deer Habitat

Most people associate deer with undisturbed forests. Actually deer do much better on timbered lands that have been cleared and settled by man. Unlogged

virgin forests with closed canopies produce only small quantities of usable deer forage. Also, due to shading, the plants that do grow here are low in protein during the winter months. Because of this low quantity and quality of food in mature coastal forest types, deer numbers are also low.

When the coastal forest is burned or logged, low growing vegetation responds quickly in both amount and quality. Because of the black-tailed deer's need for heavy cover, only the edges of large open areas are used for feeding. Therefore, in correlation of timber management and deer habitat management, the most productive results from a deer forage standpoint are obtained from a timber harvest system that results in a large number of well scattered, small, clear cut blocks or patches. Fortunately, the interests of silviculture also often call for rather narrow openings, so that natural seed fall from the uncut trees on the edges will be adequate. In douglas fir, for example, strips not over 600 feet wide are recommended. The timber cutting cycle may vary from 60 to 100 years. If the clear cut areas will be productive of deer food for about 15 years the cutting rotation should include from 4 to 6 cuttings, depending on the length of the cutting cycle.

Management brushland habitat

In California it has been estimated that there are over 7 million acres of brushlands dominated by chamise (Adenostema fasciculatum). Other brush types occupy additional millions of acres. The greatest opportunity for direct habitat improvement for deer lies within these dense brush types.

Dense stands of old growth brush produce only a fraction of the deer forage that is produced by young stands or stands that are opened up. Opening dense brush types provides a more desirable interspersion of food and cover. Where good management is applied these treated brushlands will remain productive over a long period

of time with a minimum of further disturbance. Thinning out the old growth can also be done in a way that will improve the chances for wildfire prevention and control, improve watersheds, and improve habitat for quail, doves, and rabbits.

In a study conducted by the University of California a number of years ago in Lake County (2) it was found that the number of deer in heavy, closed brush types averaged 10 to 30 per square mile; in wildfire burns 5 to 160; and in opened brush 40 to 110. Fawn production also increased with brush treatment. It was found that there were 60 to 80 fawns per 100 adult does in heavy brush areas; 100 to 110 fawns per 100 adult does on the wildfire burns and about 115 to 140 fawns per 100 adult does in opened brush. These higher populations and higher fawn production rates were attributed to better nutrition on the burned or opened brush ranges. More herbaceous forage is available on opened brush ranges and the deer diet consists largely of herbs in the late winter and early spring. The authors of this study concluded that "in the opened brush, the deer have available an excellent diet during four months of the year, foraging on abundant herbs and new sprouts (Feb-May), a good diet for another four months (Nov, Dec, Jan, and June) when some green herbs are available and sprouts are still growing in the spring and early summer; and a poor diet during the remaining four months (July-October) when the herbs are dry and the browse plants more or less dormant. In the heavy brush the deer have access to an excellent diet only two months of the year (April, May) when the brush is growing rapidly, a good diet for two months (March and June) when there is some shrub growth, and a poor diet for eight months---".

Methods for improving brushland habitat

Several practical methods have been developed to open dense brush stands for game habitat improvement. These include burning, mechanical treatment, and

application of chemicals. These methods are used singly or in combination depending on the objectives, risks involved, brush cover conditions and topographical or other features of each area.

Burning

Guidelines have been developed for safe use of fire in opening up dense brushlands. Either spring or fall burning has proven satisfactory from a game habitat improvement standpoint. Each has its advantages and disadvantages. Summer burning is not recommended because of the difficulty and expense in fire control. Spring burning before the grasses outside the brush areas become dry is usually the safest from a fire control standpoint. The cleanest and safest burns are usually preceeded by some type of brush treatment such as crushing or spraying to dry out the fuel on the area to be burned. Manipulating brush by fire is not easy and always requires careful planning and close supervision to do a good job. In chamise brushland sprouts appear in 3 or 4 weeks after spring burning and supply a highly nutritious forage for deer during the dry summer months. Spring burns do not favor brush seedling establishment. Therefore, spring burning favors sprouting species, such as chamise, over nonsprouters such as wedgeleaf ceanothus. Because of this the composition of the brush cover may be affected adversely by spring burning.

Mechanical brush treatment

Brushlands may be opened by dozing with a bulldozer blade or heavy brush rake or, in light brush, by heavy discing. Where bulldozers are used the blade is ordinarily held about 6 inches above the soil. There are several advantages in mechanically opening chamise brushlands. First, a residue is left on the soil which is helpful in erosion control and in successful establishment of herbaceous plants in the openings. Second, there is evidence that a more favorable composition of brush

cover for deer can be maintained by mechanical treatment. Third, mechanical means can be used in areas where it is too dangerous to burn. Fourth, desirable patterns of brush and grass interspersion can be obtained with less difficulty. Disadvantages are that costs are high; some areas are inaccessible to mechanical equipment; and bulldozed brush may become quite a fire hazard.

Chemical brush control

In recent years chemicals and practical means for applying them have been found that are quite effective in killing or suppressing many species of brush found on California deer ranges. Chemicals are most often used as follow-up treatments to kill or suppress seedlings or sprouts following burning or mechanical treatment. Helicopters on which boom-spray equipment has been mounted are being used quite successfully where broadcast treatment is desired. Ground spraying equipment is necessary where selective control of certain species is the objective.

Reseeding of treated brushlands

Where brush has been removed it is usually desirable to immediately reseed with grasses and legumes. Successful seedings will give protection to the bared soil, will improve the quality of the deer diet, and will prevent or at least slow down the rate of invasion of brush into the openings. Several species have been successfully used including annuals such as Blando brome, domestic ryegrass, bur clover and rose clover; and perennials such as intermediate and pubescent wheatgrass, Harding grass, orchard grass, perennial ryegrass, fescues, smilo, big bluegrass, sweet clover, and dry land alfalfa.

Deer use reseeded grasses most in early spring before brush sprouts are available. The tender new growth of grasses is high in nutrients and both annuals

and perennials are quite palatable at this time of year. Where grasses are drilled rather than broadcast it is usually desirable to include both annuals and perennials in the seed mixture. However, in broadcast grass seedings perennials often do not produce satisfactory stands. On most ranges annuals will provide a more adequate soil cover the first year after treatment. The perennials remain green for longer into the summer. Perennials also provide better long-time soil protection and more competition to re-invading brush seedlings and therefore contribute more toward permanance of the opened brush type. Legume planting is not recommended for openings where chemical spraying is planned to suppress sprouts or seedlings since legumes are also susceptible to harmone sprays. In areas where deer populations are high enough to hold brush sprouts and seedlings in check the legumes are desirable and contribute to deer nutrition.

Deer Habitat Improvement through Coordination with Livestock Use

On some ranges deer use and livestock use are in conflict. If a rate of stocking by either deer or livestock or both is permitted in excess of range capacity, competition for forage may become acute.

When deer damage occurs on private land the state agency responsible for management of the animals has an obligation to take redemial action. Several avenues are open depending upon agreement between the landowner and the state. The problem can usually be solved by reduction of the deer herd, control of deer movements, payment for the damage, or acquisition of the land envolved. Removal of deer to numbers in balance with available forage is the most practical solution. Since deer often use many plants that domestic livestock do not use and also use many areas where livestock will not go, competition is not direct. Some deer, and often

quite sizeable populations can inhabit private lands without serious conflict with livestock use. Furthermore, most stockman do not object to reasonable numbers of deer of their lands.

On public lands, the public has a right to demand a fair share of the range for wildlife. Management plans for public lands ordinarily provide for dual use by deer and livestock. On such lands habitat can often be improved for deer by some of the following measures:

1. Exclusion of livestock use from critical deer ranges.
2. Stocking of livestock ranges on the basis of grass production only.
3. Adjustment in season of livestock use to reduce use of shrubs. Ordinarily livestock use most species of browse mainly after grasses are fully utilized or after grasses have matured and cured.
4. Leaving adequate browse food and cover for deer when revegetating livestock ranges.
5. Including palatable shrubs and legumes in revegetation seed mixtures.

In summary, large scale deer habitat improvement will be easier to justify from an economic standpoint and will also produce greater and more lasting benefits when accompanied by full utilization of annual crops of deer.

BIBLIOGRAPHY

1. Allen, Durward L. 1962. Our Wildlife Legacy, Funk & Wagnalls Company Inc., New York.

2. Biswell H. H., R. E. Taber, D. W. Hedrick and A. M. Schultz, 1952. Management of Chamise Brushlands for Game in North Coast Region of California.

3. Dasmann, Wm. P. 1950. Basic Deer Management, California Fish & Game, 36(3).

3a. Dasmann, Wm. P. 1951. Some Deer Range Survey Methods, California Fish & Game 37(1).

4. Julander, Odell, W. Leslie Robinette, and Dale A. Jones, 1961. Relation of Summer Range Condition to Mule Deer Herd Productivity. The Journal of Wildlife Management, Volume 25, No. 1.

5. Leopold A. Starker, Thane Riney, Randal McCain and Lloyd Tevis, Jr., 1951. The Jawbone Deer Herd, California Dept. of Fish & Game, Game Bulletin No. 4.

6. Longhurst, William M., A. Starker Leopold and Raymond F. Dasmann, 1952. A Survey of California Deer Herds.

7. Russo, John P. 1964. The Kaibab North Deer Herd, Wildlife Bulletin No. 7, Arizona Game & Fish Department.

8. Taber, Richard D. and Raymond F. Dasmann, 1958. The Black-Tailed Deer of the Chaparral, California Dept., Fish & Game, Game Bulletin No. 8.

9. Taylor, Walter P. (Editor), 1956. The Deer of North America. The Wildlife Management Institute, Washington, D.C.

10. Thomson, W. H. 1963. Deer vs. Crops - The Increase in Depredation. Outdoor California, Volume 24, No. 10.

11. Trefethen, James B. 1964. Wildlife Management and Conservation. D. C. Heath & Co., Boston, Mass.

12. Van Dyne, George M. and Harold F. Heady, 1965. Dietary Chemical Composition of Cattle and Sheep Grazing in Common on a Dry Annual Range.